some distance (at least 20 feet) from the dispenser because the panel was not rated as electrically explosion proof (as required by the National Fire Protection Association for the dispenser).

The tank truck that brought propane gas to the site was sealed by local weights and measures. The quantity of fuel delivered was documented to verify that the calibration of the dispenser was correct. The dispenser itself was also calibrated using a standard meter supplied by the propane industry.

Operational Experience. Over the course of the demonstration there were no significant problems with the propane storage tank or dispenser.

Phase 2 RFG

The downtown Los Angeles location chosen for the RFG fleet had two 5,000-gallon, underground storage tanks, each connected to a fuel pump and dispenser. Prior to the CleanFleet project, both were used for unleaded gasoline. One of these storage tanks was pumped out, cleaned, and used for storing RFG. The RFG, which was blended and stored in bulk by Phillips in Borger, Texas, was delivered to the demonstration site in tank trucks.

There were no additional permitting requirements for the RFG supply over and above those already in place for unleaded gasoline. However, the use of this facility to load the gasoline component of the M-85 meant that the fuel dispenser hose had to be longer than normal. To maintain the efficiency of the Stage II vapor recovery system, twin hoses, rather than coaxial hoses were used.

Fuel Storage and Dispensing Equipment. The fuel storage and dispensing equipment were not modified from the existing gasoline installation. However, because the fuel pump dispenser on the RFG tank was relatively old, it was replaced with a newer unit to ensure reliability.

Recording Fuel Dispensed. The quantity of RFG dispensed into the vans was recorded using a key-lock system similar to that used for propane gas. An automated fuel management system was evaluated at this site. The CleanFleet vans were equipped with transponders that provided information on vehicle identification and odometer. Only vans identified by the fuel management system as CleanFleet RFG vans were allowed to be fueled with RFG. Other vans at the site were fueled with regular unleaded gasoline at a pump a few feet away. From the beginning of the installation, the automated system experienced problems with the hardware and software. Vendor support of the system was inadequate, and FedEx employees soon learned not to trust the automated system. If a problem appeared, they quickly manually bypassed the system. This automated system never provided useful data.

The RFG and unleaded gasoline dispensers were calibrated using standard weights and measures procedures.

Operational Experience. No problems were experienced with the RFG dispenser during the demonstration.

PROJECT DESIGN AND IMPLEMENTATION

M-85

Methanol for the M-85 was obtained from the California methanol reserve. The methanol was carried by tank truck from the terminal in Long Beach to the FedEx station in downtown Los Angeles, where the RFG fleet was kept. Here, 15 percent RFG by volume was added to the tank truck. The tank truck then proceeded to Santa Ana where the entire load was emptied into the M-85 storage tank, the fuel being splash-blended during the trip.

Permitting Requirements. The installation of the 4,000-gallon, aboveground, storage tank triggered extensive permitting requirements in Santa Ana. Altogether, over a dozen city departments were involved. In this jurisdiction, installing an aboveground fuel tank requires a conditional-use permit. The chief concerns to be addressed during the tank permitting process were:

1. **Fire.** The fire department required that the tank be set back from the property line, but also be easily accessible from the street for possible fire fighting operations.

2. **City Planning.** This planning commission was concerned with the aesthetics of the installation and with appropriateness for the commercial, light-industrial neighborhood. This commission wanted the tank located toward the rear of the property and as far from public view as possible.

3. **FedEx Operations.** FedEx operations required that tractor trailer trucks be able to maneuver on the property. Inasmuch as there was limited room on the site, installation of the fuel tank could not interfere with these operations.

As it turned out, the only location on the property acceptable to all parties was close to a fire hydrant. Thus, this fire hydrant had to be moved prior to installing the tank. Moving the hydrant triggered additional permitting requirements, including pressure testing of the new piping. The pressure testing process was complicated by a lack of adequate shut-off valves in the fire water distribution system and the need to maintain continuous service to a sprinkler system on an adjacent property that was fed from the same water supply.

As part of the fuel tank permitting process, Battelle and FedEx also agreed to:

- Replace the chain link fence in front of the tank with a wall to provide architectural screening of the installation

- Replace an existing chain link truck gate near the tank with an opaque steel gate to provide additional visual screening.

Figure 14 shows the M-85 fueling facility. Experience with this permitting process suggests that, if a fleet operator implements an alternative fuel into the fleet and plans to store the new fuel on site, local code officials may evaluate all aspects of the property, not just those pertaining specifically to the fuel itself.

Fuel Storage and Dispensing Equipment. Once the permit was obtained, installation of the fuel storage and dispensing equipment was relatively straightforward. The tank vendor installed the tank, fuel dispenser, and associated plumbing as part of a turn-key contract.

However, after an initial period of use, fuel contamination was noted. This was traced to several materials compatibility problems with the tank and dispenser installation. These included

- In some cases the installers had used galvanized pipe fittings rather than the required black iron fittings.
- The fuel pump and dispenser were listed by the vendor as "methanol compatible." However, this equipment turned out to be suitable only for gasoline with small amounts of methanol. The pump and dispenser unit were replaced with a more robust model from another vendor.
- The hose initially installed on the fuel dispenser was not methanol-compatible. This resulted in the carbon filler in the hose being released into the fuel. In an effort to "flush the system," the tank vendor's crew pumped contaminated fuel into the fuel tank.

Figure 14. An above-ground tank and dispenser were installed for the M-85 fueling facility.

After this hose and the dispenser were replaced, the tank was pumped, cleaned, and then put back into service.

- The originally installed fuel filters were not of a methanol-compatible design. During the first month or so, methanol compatible filters were not yet available from the manufacturer.

After fixing these installation problems, no further difficulty with methanol fuel quality was noted during the balance of the two-year demonstration.

Recording Fuel Dispensed. The quantity of fuel dispensed into each vehicle was recorded by a key-lock system with mechanical totalizers similar to propane and RFG. The fuel dispenser was calibrated using weights and measures procedures.

Operational Experience. After the initial problems with material compatibility were ironed out, no problems were experienced with the tank or dispenser.

Electric Vehicles

Electricity for electric vehicles was obtained through the local electrical utility (Southern California Edison) to the FedEx facility in Culver City. The numbers of electric vehicles and their associated requirements for charging were such that the existing electrical distribution service to the FedEx facility and to the main breaker panel was adequate. Therefore, the only change required was adding a separate circuit for the electric vehicle chargers.

Permitting Requirements. There were no special permitting requirements for the use of the electric vehicles in Culver City. An eyewash station was installed close to the battery chargers. The wiring for the electric chargers was installed by a local electrical contractor according to standard electrical code specifications.

Battery Chargers. Fuel (electricity) was stored on board the vehicles in batteries. The battery chargers were located within the facility, not on board the vehicles. The vehicle connection to the battery chargers was located under the hood in front of the vehicle. Because of the need to back the trucks up to a conveyer belt for loading and unloading, and also to have an unobstructed driving lane in front of the trucks, the chargers were mounted on the ceiling of the facility, with a lanyard to pull down the charging cords when needed.

Recording Electric Energy. Two digital meters were installed in the circuit to record the electrical energy provided to each charger. Information from these meters was recorded manually, as well as sent automatically to Southern California Edison.

Operational Experience. One of the original chloride chargers malfunctioned and had to be replaced. Otherwise FedEx experienced no problems with the chargers themselves.

PROJECT DESIGN AND IMPLEMENTATION